

Session 11 : Natural Products/Essential Plant Oils**Effectiveness of plant essential oils against insect and mite pests of stored products**

Insung, A.*#, Pumnuan, J.

Department of Plant Production Technology, Faculty of Agricultural Technology, King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand

*Corresponding author, Email: kiammorn@kmitl.ac.th

#Presenting author, Email: kiammorn@kmitl.ac.th

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Abstract

At least 30 insect and 10 mite species have been reported as pests of stored products in Thailand. Essential oils are potential alternatives to current fumigants because of their low toxicity to warm-blooded mammals, high volatility and having fumigation toxicity to stored grain insect and mite pests. Furthermore, it is a chance to fulfill the integrated pest management program when methyl bromide and phosphine are typically limited in use. Toxicity and repellency properties of essential oils obtained from 4 selected medicinal plants, namely, clove (*Syzygium aromaticum* (Linnaeus) Merr&L.M.Perry), lemon grass (*Cymbopogon citratus* (DC.ex.Nees)), star anise (*Illicium verum* Hook.f.) and dill (*Anethum graveolens* Linnaeus) against adults of flour weevil, *Tribolium castaneum* (Herbst), saw-toothed grain beetle, *Oryzaephilus surinamensis* Linnaeus and corn weevil, *Sitophilus zeamais* Motschulsky were performed. The result showed that essential oils of star anise, clove and dill at 0.08 $\mu\text{l}/\text{cm}^2$ caused 93.3, 76.7 and 63.3% mortality of *O. surinamensis*, respectively. Lemon grass essential oil gave the most repellency effect against all insect species with more than 40% RI (repellent index). Thereafter, the insecticidal property of essential oils obtained from 22 medicinal plants against *O. surinamensis* adult was investigated by using fumigation method. The result presented that star anise essential oil showed the most toxic effect to this insect with LC_{50} of 7.17 $\mu\text{l}/\text{L}$ air. By the same way, fumigation toxicity of some plant essential oils against *S. zeamais* resulted in clove essential oil had the highest activity with LC_{50} of 2.65 $\mu\text{l}/\text{L}$ air. Essential oil formulas, the different proportions between star anise and dill were tested to *S. zeamais*. It was found that proportion 3:1 at the concentration of 0.016 $\mu\text{l}/\text{cm}^2$ showed the highest repellency effect, greater than 90% RI was observed. This essential oil formula also showed remarkably ovipositional inhibition effect. As for stored product mite experiments, extracts of pepper (*Piper retrofractum* Vahl) and tarragon (*Artemisia dracuncululus* (Linnaeus)) at 1% concentration could kill the mold mite, *Tyrophagus putrescentiae* (Schrank) for 95 and 68.2%, respectively. Essential oils from 28 medicinal plant species tested against *Suidasia pontifica* Oudemans revealed that clove essential oil was the most toxic to the mite in which presented LD_{50} of high activity of 0.17 $\mu\text{g}/\text{cm}^3$ by fumigation method. Cinnamon (*Cinnamomum bejolghota* (Buch.-Ham.) Sweet) essential oil was relatively the most toxic, with LD_{50} of 24.05 $\mu\text{g}/\text{cm}^2$ by dry film method. Besides, the mixture of clove and cinnamon essential oils at the concentration 2% showed satisfactory result in order to control various stored product mites in animal feed factory. Lastly, turmeric (*Curcuma longa* Linnaeus) essential oil presented high potent fumigant toxicity to the mold mite, *Tyrophagus* sp. It gave 100% mortality within 1 h at 1.8 $\mu\text{l}/\text{L}$ air and presented LC_{50} of 0.66 $\mu\text{l}/\text{L}$ air. It was also highly toxic against the mite by residual method. In conclusion, many plant essential oils showed high fumigant toxicity against insect and mite pests of stored products. However, their active compound and modified application studies are still needed.

Keywords: essential oil, fumigant toxicity, repellency effect, stored product pests